Cognition 175 (2018) 141–156

Contents lists available at ScienceDirect

Cognition

journal homepage: www.elsevier.com/locate/cognit

Original Articles

Reversing the similarity effect: The effect of presentation format

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ARTICLE INFO

Keywords:
Similarity effect
Context effects
Mathematical modeling
Information presentation format

ABSTRACT

A context effect is a change in preference that occurs when alternatives are added to a choice set. Models of preferential choice that account for context effects largely assume a within-dimension comparison process. It has been shown, however, that the format in which a choice set is presented can influence comparison strategies. That is, a by-alternative or by-dimension grouping of the dimension values encourage within-alternative or within-dimension comparisons, respectively. For example, one classic context effect, the compromise effect, is strengthened by a by-dimension presentation format. Extrapolation from this result suggests that a second context effect, the similarity effect, will actually reverse when stimuli are presented in a by-dimension format. In the current study, we presented participants with a series of apartment choice sets designed to elicit the similarity effect, with either a by-alternative or by-dimension presentation format. Participants in the by-alternative condition demonstrated a standard similarity effect; however, participants in the by-dimension condition demonstrated a strong reverse similarity effect. The present data can be accounted for by Multialternative Decision Field Theory (MDFT) and the Multiattribute Linear Ballistic Accumulator (MLBA), but not Elimination by Aspects (EBA). Indeed, when some weak assumptions of within-dimension processes are met, MDFT and the MLBA predict the reverse similarity effect. These modeling results suggest that the similarity effect is governed by either forgetting and inhibition (MDFT), or attention to positive or negative differences (MLBA). These results demonstrate that flexibility in the comparison process needs to be incorporated into theories of preferential choice.

1. Introduction

Multi-alternative, multi-attribute choice involves selecting one of a set of alternatives, each of which varies on at least two attributes or dimensions. An important collection of results demonstrates that adding alternatives to such a choice set can change preferences among the original alternatives. Prior studies of these context effects have shown that the comparison process, i.e., how the dimension values of the alternatives are compared, plays an important role in choice behavior. The comparison process, however, can be altered by the manner in which stimulus information is presented (Bettman & Kakkar, 1977; Biehal & Chakravarti, 1982). For example, a presentation format that encourages within-dimension comparisons facilitates the compromise effect, a well-established context effect (Chang & Liu, 2008). In an effort to better characterize the processes underlying context-dependent choice, the present research extends this work by testing the influence of presentation format on a related context effect, the similarity effect.

The paper proceeds as follows. We first present the similarity effect as a significant behavioral phenomenon that demonstrates the importance of the comparison process in preferential choice. We then review previous research on the effect of presentation format on preferential choice, in general, and the compromise effect, in particular. We next introduce an experiment to test the influence of presentation format on the similarity effect. To preview the results, the similarity effect is successfully replicated when within-alternative comparisons are encouraged; however, a strong *reverse* similarity effect is observed when within-dimension comparisons are encouraged. These findings extend previous empirical work with other context effects, support the novel predictions of popular models of preferential choice, and highlight the idea that the similarity effect, in contrast to the other context effects, is produced by a distinct mechanism. Three computational models of preferential choice, Elimination by Aspects (EBA; Tversky, 1972), Multialternative Decision Field Theory (MDFT; Roe, Busemeyer, & Townsend, 2001), and the Multiattribute Linear Ballistic Accumulator (MLBA; Trueblood, Brown, & Heathcote, 2014), are tested on their ability to quantitatively account for both the similarity and the reverse similarity effects and are used to identify potential processing differences across presentation formats. Whereas the EBA fails to account for the results, the data are well described by both the MDFT and MLBA. We conclude with a discussion of possible explanations for these

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https://doi.org/10.1016/j.cognition.2018.02.003
Received 30 October 2017; Received in revised form 25 January 2018; Accepted 6 February 2018

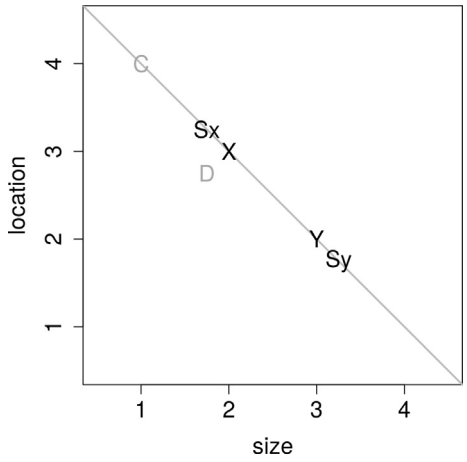

Fig. 1. Each label represents the dimension values of an apartment. The black apartment values were used in the current experiment. The gray apartment values are for illustrative purposes. The presented ratings are for the EV = 2.5 condition. For the EV = 1.5 condition, all ratings were one unit lower.

findings and identify areas of future study.

1.1. The similarity effect

A decision-making context effect is a change in preference that occurs when alternatives are added to a choice set. These effects serve as central examples of how the decision process can deviate from the principles of rational choice, and, as a result, have often been used as benchmark behavioral effects for theories of choice. Because individual context effects are associated with specific qualitative and quantitative behavioral predictions, they also represent ideal tools for examining the component processes of decision making.

The three most commonly studied context effects are the similarity, compromise, and attraction effects. Consider the scenario of choosing between several apartments that vary in ratings of their size and location, as depicted in Fig. 1. The axes depict the dimension values and each labeled point provides the dimension values of an alternative. First, consider a choice between apartments X and Y. Apartment X rates well on location but poorly on size, and apartment Y rates poorly on location but well on size. Because of the dimension trade-offs, assuming equal dimension weights, these two apartments would be valued equally. Indeed, all alternatives on the diagonal indifference line will have equal value. Now, suppose that a third apartment becomes available and there is a choice between the three apartments. The similarity effect (Tversky, 1972) is the finding that the addition of apartment S_X in Fig. 1, which is similar to apartment X and dissimilar to apartment Y, but still on the indifference line, increases the preference of apartment Y over apartment X. The compromise effect (Simonson, 1989) is the finding that the addition of apartment C in Fig. 1 increases preference for apartment X, which now has intermediate values on both dimensions. The attraction effect (Huber, Payne, & Puto, 1982) is the finding that the addition of apartment D, which is similar to, but dominated by, apartment X, increases the preference for apartment X over apartment Y.

The present paper focuses on the similarity effect. Despite its long history and theoretical importance, most of the empirical work on the similarity effect is relatively recent. The similarity effect has been studied in consumer choice (Berkowitsch, Scheibehenne, & Rieskamp, 2014; Diels & Müller, 2013; Liew, Howe, & Little, 2016; Noguchi & Stewart, 2014; Tversky, 1972), gambles (Tversky, 1972), perceptual judgment (Trueblood, Brown, & Heathcote, 2015; Trueblood, Brown, Heathcote, & Busemeyer, 2013; Trueblood et al., 2014), and inference (Liew et al., 2016; Trueblood, 2012; Trueblood et al., 2014).

To more fully illustrate the similarity effect and how it is measured, consider again the scenario of choosing between apartments as depicted in Fig. 1. Consider a choice between apartments X and Y. This time, assume uneven dimension weighting, for example, a particular individual may value location slightly more than size. Then the probability of choosing apartment X will be slightly greater than the probability of choosing apartment Y, i.e., $P(X \mid X, Y) > P(Y \mid X, Y)$. Next, suppose that apartment S_X becomes available. An early formulation of the similarity effect (e.g., Tversky, 1972) refers to the observation that the introduction of apartment S_X may actually result in a reversal in the order of preference between the original two apartments, i.e., $P(X \mid X, Y, S_X) < P(Y \mid X, Y, S_X)$. This phenomenon violates a principle of rational choice known as independence from irrelevant alternatives (Tversky, 1972), which states that the order of preference between two alternatives should be constant regardless of the choice set. As a result, the similarity effect has come to serve as a core example of how the human decision process deviates from rationality.

More recent work has measured the similarity effect as a comparison between two three-choice scenarios, for example, a choice between X, Y, and S_X and a choice between X, Y, and S_Y in Fig. 1 (Wedell, 1991). Under this framework, the similarity effect is obtained if $P(X \mid X, Y, S_X) < P(Y \mid X, Y, S_X)$, but $P(Y \mid X, Y, S_Y) < P(X \mid X, Y, S_Y)$. This three-choice definition of the similarity effect has two main advantages. First, because the choice probabilities for both X and Y are expected to shift, it allows for two measures of the similarity effect. A shift of both X and Y in the right direction provides strong evidence for the similarity effect. A shift in only one of X or Y, however, may be attributable to a dimension bias effect. For example, a bias for location could produce $P(X \mid X, Y) > P(X \mid X, Y, S_X)$ in isolation, i.e., without a parallel shift in Y. Second, because $P(X \mid X, Y, S_X) < P(X \mid X, Y) < P(X \mid X, Y, S_Y)$ and $P(Y \mid X, Y, S_Y) < P(Y \mid X, Y) < P(Y \mid X, Y, S_X)$, the expected effect size should be larger when comparing two three-choice sets. Given these benefits, the current experiment uses the three-choice comparison.

Note that a reversal in choice preference is a qualitative effect. In order to quantify the effect, previous research (e.g., Trueblood et al., 2014) has measured the extent of the effect by $P(X \mid X, Y, S_Y) - P(X \mid X, Y, S_X)$ and $P(Y \mid X, Y, S_X) - P(Y \mid X, Y, S_Y)$. Note that this formulation now compares choice proportions of the same alternative across choice sets, and therefore no longer requires the assumption that X and Y are associated with particular probabilities in a two-choice scenario, e.g., that X is initially preferred, $P(X \mid X, Y) > P(Y \mid X, Y)$. The similarity effect holds if these differences are positive. Given the benefits of studying a quantitative shift, we also adopt this approach. To show qualitative preference shifts, and to avoid spurious conclusions generated by dimensional bias, where possible, we also present data for each alternative in each condition.

Most computational models that simultaneously explain the three main context effects do so by specifying a distinct account for the similarity effect (Bhatia, 2013; Roe et al., 2001; Trueblood et al., 2014; Usher & McClelland, 2004). Multialternative Decision Field Theory (MDFT; Roe et al., 2001), the Leaky Competing Accumulator (LCA; Usher & McClelland, 2004), and the Associative Accumulation Model (AAM; Bhatia & Mullett, 2016) assume that the similarity effect occurs due to positively correlated comparisons between each of the similar alternatives and the dissimilar alternative. In MDFT, the similarity effect occurs in spite of lateral inhibition, a mechanism that is crucial to explaining the attraction and compromise effects. In the LCA, the similarity effect occurs in spite of loss aversion, again crucial to its accounts of the attraction and compromise effects. In the AAM, the similarity effect occurs independently of associative connectivity, which accounts for the attraction and compromise effects. Finally, the Multiattribute Linear Ballistic Accumulator (MLBA; Trueblood et al., 2014) assumes that, unlike the attraction and compromise effects, the similarity effect occurs due to a type of confirmation bias, i.e., greater attention to positive comparisons than to negative comparisons. This relationship between the context effects is supported by within-subject analyses in which the similarity effect was found to be negatively